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(54) **A signal quality detecting circuit for FM receivers.**

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Description

The present invention relates in general to identifying signal quality of a received radio transmission, and more specifically to an indicating circuit for detecting the presence of a strong FM signal without the presence of noise or interference. The present application is related to U.S. application Serial No. (88-506) filed concurrently herewith.

The measurement of received signal quality has been employed in FM receivers for implementing a number of different functions. For example, automatic scan tuners which sweep through the FM broadcast band must terminate a scan when a broadcast signal is received having a particular signal quality. Signal quality is also measured in order to modify receiver characteristics in response to certain conditions, e.g., output blanking or reducing stereo separation in response to the presence of noise.

Several different methods have been employed to generate a stop signal for terminating the sweep operation in an automatically scanning tuner. Most methods rely on a measure of the received signal strength, or a frequency window determined by the automatic frequency control (AFC) signal, or a combination of both. Integrated circuits are commercially available which provide FM intermediate frequency (IF) demodulating systems. These systems include signal strength level detectors and AFC window detectors that are or can be interconnected to generate stop pulses for scan tuning operations (e.g., the CA3209E integrated circuit made by RCA Solid State Division and the TDA 4220 integrated circuit made by Siemens).

The presence of a received signal strength greater than a predetermined magnitude provides an insufficient indicator of signal quality to stop a scan tuning operation because the received signal strength may be high while signal quality is low due to the presence of noise, adjacent channel interference, or multipath interference. Even with the use of a frequency window to ensure that scanning is stopped accurately at the frequency of a strong received signal, stopping on a received signal which includes noise and interference continues to be a problem.

It is also known to examine the noise component of a signal relative to the information signal component in order to determine signal quality. For example, communications transceivers employ output inhibiting or squelch when a particular level of noise is present. However, the prior art systems measure noise at frequencies that also contain information-related components. Therefore, only noise that is substantially equal to or greater than the information component can be detected.

A radio receiver having adjustable squelch means and including demodulator means, intelligence processing means including gating means, and squelch circuit means for controlling the gating means. The squelch circuit includes voltage dividing means which controls the amplitude of a squelch drive signal and/or a reference signal. Squelch control adjustment means provides variable resistance paths around each of the divider network resistive elements.

Patent abstract of Japan, Vol. 8, No. 84 discloses a stop signal generating circuit for searching broadcasting station in which a signal of intermediate frequency from a front end part is reduced in band through a band-pass filter and then inputted to a level detector through an amplifier to supply a control signal corresponding to the intensity of an input electric field to a voltage comparator. The output of the front end part is inputted to a wide-band filter simultaneously to detect a disturbing signal and a wide-band noise which are amplified by a noise amplifier to output a variable DC control voltage from a noise level detector. A voltage comparator generates a stop signal for searching broadcasting station at the point where the control signal C and variable DC voltage cross each other and output no stop signal when the disturbing wave or noise component level is high.

IEEE Transaction on Consumer Electronic Vol. CE28, No. 3, August 1982, New York, US; Pages 383-392, discloses an FM-IF integrated circuit for use in ETRs as well as traditional radio designs. This circuit has been designed to reduce external components while improving the overall radio performance. For example, this I.C. implements a new quadrature detector which not only reduces distortion but broadens the off frequency distortion characteristic using only a single tuned quadrature coil. Further it includes a dual threshold AGC which eliminates the need for a local/distance switch and offers immunity from third order intermodulation products due to tuner overload. The signal level stop function has been simplified by providing a user adjustable signal level stop threshold, controlled either by ultrasonic noise in the recovered audio or by the meter output.

It is a principal object of the present invention to detect the reception of an FM signal having a predetermined signal quality in a manner which is highly sensitive to noise levels.

It is a further object of the invention to provide apparatus and method for detecting the presence of a high quality received FM broadcast signal which is accurately tuned in and which is substantially unaffected by noise.

It is another object of the invention to provide for scan tuning of an FM radio wherein a scan operation is stopped only when a signal is received having a predetermined signal quality.

It is still another object to improve the listening quality of a received signal whenever the detected quality falls below a predetermined value.

These and other objects are achieved by a qual-

ity detecting circuit for an FM receiver. The receiver includes an IF detector generating an intensity signal indicating the received field strength of the FM signal being received. The receiver also includes an FM demodulator which generates an automatic frequency control signal indicating the amount of error between the value of the carrier frequency of the FM signal as received and its correct value. The quality detecting circuit comprises a level detector means adapted to be coupled to the IF detector for producing a first signal when the intensity signal is greater than a predetermined intensity. Window detector means is adapted to be coupled to the FM demodulator for producing a second signal when the automatic frequency control signal is within a predetermined window. Noise filter means is adapted to be coupled to the IF detector for generating a filtered noise signal derived from the intensity signal. The filter means rejects frequencies containing components related to the intelligence contained in the FM signal. Peak detector means is coupled to the noise filter means for producing a third signal when the filtered noise signal is below a predetermined peak value. Logic means is coupled to the level detector means, the window detector means, and the peak detector means for producing an indicating signal in response to the simultaneous occurrence of the first, second, and third signals to indicate that a high quality FM signal is being received.

The invention will now be described further, by way of example, with reference to the accompanying drawings, in which :

Figure 1 is a block diagram of a scan tuning FM receiver according to the prior art.

Figure 2 is a logarithmic plot showing frequency ranges for various signal components present within an FM receiver.

Figure 3 is a block diagram showing a signal quality detecting circuit according to the present invention.

Figure 4 is a block diagram showing a scan tuning FM receiver employing a stop circuit according to the present invention.

Figure 5 is a schematic and block diagram showing an FM noise controller according to the present invention.

Figure 1 shows a well known FM receiver architecture including an antenna 10, an RF section 11, an IF section 12, a demodulator 13, a stereo decoder 14, left and right audio amplifiers 15 and 17, and stereo speakers 16 and 18. Electronic tuning of the FM receiver is accomplished by means of a scan tuner 20 which provides a tuning voltage over a line 21 to RF section 11. A local oscillator contained in RF section 11 provides a local oscillator signal used for deriving an intermediate frequency. The local oscillator signal is also provided from RF section 11 to scan tuner 20 over a line 22 for implementing electronic control over the RF tuning using a phase locked loop, for example.

Scan tuning of the FM receiver is implemented by sweeping the tuning voltage provided over line 21 in response to a start signal 23 provided to scan tuner 20. Sweeping of the tuning voltage continues automatically until an FM signal is received meeting the criteria for identifying a signal of a predetermined quality. When such a signal is received, a stop signal is provided to scan tuner 20 from a stop circuit 25. An intensity signal is provided from IF section 12 to stop circuit 25 and an automatic frequency control (AFC) signal is provided from demodulator 13 to stop circuit 25. As taught in the prior art, stop circuit 25 generates a stop signal in response to the intensity signal being above a predetermined intensity and the AFC signal being within a frequency window to indicate that the station is accurately tuned in.

The conventional stop circuit shown in Figure 1 has the disadvantage that it may stop on a sideband of a strong signal, or on a signal contaminated by noise or interference.

In order to reduce the false stopping or identification of such noisy signal as a good quality signal, the present invention analyses an additional characteristic of the signal to produce a high quality FM signal detector.

Figure 2 shows a signal spectrum within an FM receiver plotted on a logarithmic scale. An FM receiver output is affected by broadband noise which is present across the entire spectrum. A range of frequencies 26 is identified which includes FM broadcast signals and harmonics. The FM signals include the stereo sum baseband channel from zero to 15 KHz, a pilot signal at 19 KHz, stereo difference channel sidebands extending from 23 KHz to 53 KHz, and a subsidiary communication authorization (SCA) signal from 60 to 74 KHz. In Europe, the FM signal also includes a subcarrier at 57 KHz for modulating traffic and other information according to the Radio Data System (RDS) employed there. Harmonics from these various FM signals appear in the FM receiver extending up to the upper end of range 26 at about 100 KHz to about 150 KHz. The harmonics or other nonlinear products from signal mixing are caused by IF filters and limiting amplifiers, for example.

A range of frequencies 28 extends from 5 MHz and higher and includes intermediate frequency signals and radio frequency signals orginating in tuned-in or nearly tuned-in FM broadcasts. The intermediate frequency of an accurately tuned in signal is located at about 10.7 MHz, but IF signals from adjacent channels can appear somewhat below 10.7 MHz.

The signals present in the FM receiver in frequency ranges 26 and 28 contain the information content of the desired FM signal being received. However, a range of frequencies 27 extending from about 100 KHz to about 5 MHz contains noise only. Frequency range 27 lacks any signal components related to the intelligence contained in the FM signal being received

and is used herein to derive a measure of signal noise which is not masked by the information signal content.

Figure 3 shows a quality detecting circuit 30 including a noise detector 31 receiving the field intensity signal produced by a conventional IF detector (not shown). The field intensity signal is sometimes referred to as the stereo blend signal. The intensity signal is further provided to a level detector 32. The AFC signal provided by a conventional demodulator (not shown) is input to a window detector 33. The outputs of noise detector 31, level detector 32, and window detector 33 are respectively input to a logic circuit 34. The output of logic circuit 34 provides an indicating signal 35 which can be employed as a stop signal, for example.

In operation, noise detector 31 isolates that frequency range of the intensity signal which contains no components related to the FM signal intelligence. The isolated noise signal is compared to a predetermined value and a signal is provided to logic circuit 34 when the isolated noise signal is below the predetermined value. Level detector 32 compares the intensity signal to a predetermined intensity and produces an output signal transmitted to logic circuit 34 when the intensity signal is greater than the predetermined intensity. Window detector 33 compares the AFC signal to a pair of window threshold values and generates an output signal which is coupled to logic circuit 34 when the AFC signal is within the predetermined window to indicate that the FM station is accurately tuned in. Logic circuit 34 preferably performs an AND function for generating indicating signal 35 when signals from noise detector 31, level detector 32, and window detector 33 are simultaneously received.

Figure 4 shows an FM scan tuning receiver having a stop circuit according to the present invention and using typical integrated circuits for major portions of the receiver. An antenna 40 is coupled to a receiver front end IC 41. IC 41 includes an FM tuner 42 and an IF amplifier and filter section 43. The output of IF amplifier and filter section 43 is connected to an multistage IF limiting amplifier 45 in an IF demodulating system IC 44. The amplitude limited IF signal from multistage amplifier 45 is coupled to an FM demodulator 46 which provides a composite audio output having stereo sum and difference channels. Each amplifying stage in multistage amplifier 45 is connected to an IF level detector 47 that generates an intensity signal which is proportional to the field intensity at which the FM signal is being received. The intensity signal is provided to a level detector and frequency window detector 48 which also receives an AFC signal from FM demodulator 46. Detector 48 provides an output signal to one input of an AND gate 55 in a high quality detector circuit 50. Quality detector circuit 50 implements the functions of quality detecting circuit 30 (Figure 3) that are not already implemented in IC 44 in Figure 4. In other words, level detector and frequency window detector 48 performs the functions of level detector 32, window detector 33, and part of logic circuit 34 in Figure 3.

The intensity signal from IF level detector 47 is provided across a threshold setting potentiometer 51. A threshold tap 52 couples an attenuated intensity signal to a bandpass filter 53. The filtered intensity signal is provided from bandpass filter 53 to a noise amplifier and peak detector 54. Potentiometer 51, filter 53, and noise amplifier and detector 54 correspond to noise detector 31 in Figure 3. The output of detector 54 is connected to the remaining input of AND gate 55.

The output of AND gate 55 provides a stop signal (i.e., indicating signal) 56 which is coupled to a microprocessor-controlled phase locked loop scan tuning circuit 57. Circuit 57 receives a start signal 58 in response to operator actuation of a scan tuning operation. A phase lock loop tuning voltage 60 is provided from circuit 57 to FM tuner 42 which contains a local oscillator. The local oscillator signal 61 is provided from FM tuner 42 to scan tuning circuit 57.

In operation, bandpass filter 53 provides a noise signal not related to FM signal intelligence by virtue of the pass band of bandpass filter 53 being in the range from 100 KHz to about 5 MHz. Preferably, bandpass filter 53 has a lower cutoff frequency equal to about 200 KHz and an upper cutoff frequency equal to about 2 MHz or has a smaller passband within that range. Detector 54 detects the peak value of the filtered noise and compares the detected peak value with a predetermined peak value. Detector 54 generates a high logic signal output when the noise signal is below a predetermined peak value. If the intensity signal is greater than the predetermined intensity and if the frequency error signal (i.e., AFC signal) is within the frequency window, then detector 48 also generates a high logic level output and AND gate 55 generates a high level output. The resulting stop signal 56 stops a scan tuning operation only on received signals of the highest quality. By virtue of the pass band of bandpass filter 53, scanning will not stop on any FM signal including an unacceptable level of any noise including thermal noise, adjacent channel interference noise, multipass distortion noise, overmodulation noise, or digital noise.

Turning now to Figure 5, the present invention can be used in activating an ultrasonic noise filter for improving listening quality when overall signal quality is degraded. Thus, a demodulator 65 receives an IF signal to produce a composite audio output on a line 67. Composite audio output 67 is passed through a switchable low-pass filter 66 to generate a filtered composite audio output 72. Filter 66 preferably includes a plurality of stages, each having a series connected resistor 75 and operational amplifier 76. A filter-stage switch transistor 78 has a collector coupled to the junction of resistor 75 and operational amplifier

76 through a capacitor 77. The emitter of transistor 78 is connected to a DC reference voltage 68 provided by demodulator 65. The collector and emitter of transistor 78 are coupled by a resistor 79 which has a higher resistance than resistor 75 and keeps capacitor 77 at the DC reference voltage independent of the state of transistor 78. A capacitor 80 is coupled between the line carrying DC reference voltage 68 and ground.

Indicating signal 35 from quality detecting circuit 30 (Figure 3) is provided to the input of a monostable multivibrator 70. A filter control pulse is provided from monostable multivibrator 70 over a line 71 to the base of filter switch transistors 78.

In operation, the logic level of indicating signal 35 is high when the FM signal being received has a high quality. Monostable multivibrator 70 is provided such that it will be triggered to generate an output pulse by a negative going transition of indicating signal 35. While indicating signal 35 remains high, there is no control pulse over line 71 to switch on filter 66. Therefore, composite audio output 67 is passed through filter 66 unchanged to provide the filtered composite signal 72. When interference or noise is present in the received FM signal, indicating signal 35 will oscillate between high and low states. A filter control pulse of a predetermined duration is generated by monostable multivibrator 70 to activate low pass filter 66. The characteristics of low pass filter 66 are such that frequencies below about 19 KHz (i.e., frequencies containing the stereo sum channel and the FM pilot signal) are substantially unaffected while higher frequencies which include the stereo difference sidebands are attenuated.

DC reference voltage 68 is applied to the emitters of switching transistor 78 to provide the same biasing DC potential to the filter as is present in the composite output of the demodulator 65 in order to avoid audio pops when the filter is switched to an active or an inactive state. In other words, demodulator 65 and filter 66 are biased to the same DC reference voltage such that their outputs swing about the same voltage thereby avoiding a change in bias level when filter 66 is switched on or off.

Claims

1. A signal quality detecting circuit for an FM receiver, said receiver including an IF detector generating an intensity signal indicating the received field strength of the FM signal being received and including an FM demodulator generating an automatic frequency control signal indicating a frequency error at which said FM signal is being received, said signal quality detecting circuit comprising level detector means (32,48) adapted to be coupled to said IF detector for producing a first signal when said intensity signal is greater than a predetermined intensity, window detector means (33) adapted to be coupled to said FM demodulator for producing a second signal when said automatic frequency control signal is within a predetermined window, characterized by noise filter means (31,53) adapted to be coupled to said IF detector for generating a filtered noise signal derived from said intensity signal, said filter means rejecting frequencies containing components related to the intelligence contained in said FM signal, peak detector means (31) coupled to said noise filter means for producing a third signal when said filtered noise signal is below a predetermined peak value, and logic means (34) coupled to said level detector means, said window detector means, and said peak detector means for producing an indicating signal (35) in response to the simultaneous occurrence of said first, second, and third signals to indicate that a high quality FM signal is being received.

2. A circuit as claimed claim 1, further comprising threshold control means (51,52) coupled to said noise filter means (53) for attenuating said filtered noise signal.

3. A circuit as claimed in claim 1, wherein said noise filter means (53) has a lower cutoff frequency to block all frequencies below about 100 kilohertz.

4. A circuit as claimed in claim 1, wherein said noise filter means (53) has a lower cutoff frequency equal to about 200 kilohertz.

5. A circuit as claimed in claim 1, wherein said noise filter means (53) has an upper cutoff frequency to block all frequencies above about 5 megahertz.

6. A circuit as claimed in claim 1, wherein said noise filter means (53) has an upper cutoff frequency equal to about 2 megahertz.

7. An FM receiver for receiving FM broadcast signals, comprising, front end tuner means (42) for tuning to an FM signal, an IF amplification stage (45) coupled to said front end tuner means, IF detector (47) coupled to said IF amplification stage for generating a field intensity signal, an FM demodulator (46) coupled to said IF amplification stage (45), said FM demodulator generating an automatic frequency control signal and an audio output signal and the signal quality detecting circuit as claimed in claim 1.

8. A receiver as claimed in claim 7, further comprising, scan tuning means (52) coupled to said front

end tuner means (42) and to said logic means for scan tuning said receiver in response to a start signal and for stopping said scan tuning in response to said indicating signal.

9. A receiver as claimed in claim 7, further comprising, noise controller means (70) coupled to said FM demodulator (46) and to said logic means for reducing ultrasonic frequencies contained in said audio output signal from said FM demodulator (46) in response to the absence of said indicating signal.

10. A receiver as claimed in claim 9, wherein said noise controller means comprises a monostable multivibrator (70) receiving said indicating signal and a switch-controlled low-pass filter (60) receiving said audio output signal, said switch-controlled low-pass filter (66) being activated by said monostable multivibrator to attenuate said ultrasonic frequencies.

11. A method for indicating that an FM signal having a predetermined signal quality is being received by an FM receiver, said method comprising the steps of, generating a field intensity signal proportional to the field intensity at which said FM signal is being received, generating a filtered noise signal derived from said field intensity signal in a filter rejecting at least frequencies below about 100 kilohertz and above about 5 megahertz, generating a first signal when said filtered noise signal is below a predetermined peak value, and generating an indicating signal in response to at least said first signal to indicate that a high quality FM signal is being received.

Patentansprüche

1. Ein Schaltkreis zur Erfassung der Signalqualität für einen Frequenzmodulations-Empfänger, (FM) wobei der besagte Empfänger einen Zwischenfrequenzdetektor (IF) enthält, der ein Intensitätssignal erzeugt, das die empfangene Feldstärke des eingehenden FM-Signals angibt und der einen FM-Demodulator enthält, der ein automatisches Frequenzkontrollsignal erzeugt, das einen Frequenzfehler anzeigt; an dem das besagte FM-Signal empfängen wird, wobei der besagte Schaltkreis zur Erfassung der Signalqualität Niveaudetektor-Vorrichtungen (32, 48) enthält, die so ausgelegt sind, dass sie an den besagten Zwischenfrequenzdetektor (IF) zur Erzeugung eines ersten Signals angeschlossen werden, wenn das besagte Intensitätssignal grösser als eine vorbestimmte Intensität ist, eine Bereichdetektor-Vorrichtung (33), die so ausgelegt ist, dass sie an den besagten FM-Demodulator zur Erzeugung eines zweiten Signals angeschlossen wird, wenn das besagte automatische Frequenzkontrollsignal innerhalb eines vorbestimmten Bereichs liegt, durch Geräuschfilter-Vorrichtungen (31, 53) gekennzeichnet, die zum Anschluss an den besagten Zwischenfrequenzdetektor (IF) ausgelegt sind, zur Erzeugung eines gefilterten Geräuschsignals, das vom besagten Intensitätssignal abgeleitet ist, wobei die besagte Filtervorrichtung Frequenzen ausscheidet die Komponenten enthalten, die sich auf Nachrichten beziehen, die im besagten FM-Signal enthalten sind, wobei die Höchstwerterfassungs-Vorrichtung (31) an die besagte Geräuschfiltervorrichtung zur Erzeugung eines dritten Signals angeschlossen ist, wenn sich das besagte gefilterte Geräuschsignal unter einem vorbestimmten Höchstwert befindet und logische Vorrichtungen (34) die an die besagte Niveaudetektor-Vorrichtung, besagte Bereichdetektorvorrichtung und besagte Höchstwertdetektor-Vorrichtung angeschlossen sind, zur Erzeugung eines Anzeigesignals (35), als Antwort auf das besagte erste, zweite und dritte Signal, die anzeigen, dass ein hochwertiges FM-Signal eintrifft.

2. Ein Schaltkreis nach Anspruch 1, der ausserdem Schwellenkontrollvorrichtungen (51, 52) enthält, die an die besagte Geräuschfiltervorrichtung (53) angeschlossen sind, um das besagte gefilterte Geräuschsignal abzuschwächen.

3. Ein Schaltkreis nach Anspruch 1, in dem die besagte Geräuschfiltervorrichtung (53) eine niedrigere Abschaltungsfrequenz zur Blockierung aller Frequenzen unter ungefähr 100 KHz, hat.

4. Ein Schaltkreis nach Anspruch 1, in dem die besagte Geräuschfiltervorrichtung (53) eine niedrigere Abschaltungsfrequenz hat, die ungefähr bei 200 KHz liegt.

5. Ein Schältkreis nach Anspruch 1, in dem die besagte Geräuschfiltervorrichtung (53) eine obere Abschaltungsfrequenz zur Blockierung aller Frequenzen über ungefähr 5 Megahertz hat.

6. Ein Schaltkreis nach Anspruch 1, in dem die besagte Geräuschfiltervorrichtung (53) eine obere Abschaltungsfrequenz von ungefähr 2 Megahertz hat.

7. Ein FM-Empfänger zum Empfang von FM-Funkübertragungs-Signalen, bestehend aus einer Endtunervorrichtung (42), zur Abstimmung eines FM-Signals, einer Zwischenfrequenz-Verstärkungsstufe (45), die an die besagte vordere

Endtunervorrichtung angeschlossen ist, einem Zwischenfrequenz-Detektor (47) (IF), der an die besagte Zwischenfrequenz-Verstärkungstufe zur Erzeugung eines Feldintensitätssignals angeschlossen ist, einem FM-Demodulator (46), der an die besagte Zwischenfrequenz-Verstärkungsstufe (45) angeschlossen ist, wobei der besagte FM-Demodulator ein automatisches Frequenzkontrollsignal und ein Audioabgabesignal erzeugt und dem Schaltkreis zur Erfassung der Signalqualität nach Anspruch 1.

8. Ein Empfänger nach Anspruch 7, der ausserdem eine Abtastungstunervorrichtung (52) enthält, die an die besagte vordere Endtunervorrichtung (42) und an die besagte logische Vorrichtung zum Abtastungstuning des besagten Empfängers als Antwort auf ein Startsignal und zum Abbrechen des besagten Abtastungstunervorgangs als Antwort auf das besagte Anzeigesignal angeschlossen wird.

9. Ein Empfänger nach Anspruch 7, der ausserdem eine Geräuschkontrollvorrichtung (70) enthält, die an den besagten FM- Demodulator (46) und an die besagte logische Vorrichtung zur Reduzierung der Ultraschallfrequenzen, die sich im besagten Audioabgabesignal des besagten FM-Demodulators (46) befinden, angeschlossen ist, als Antwort auf ein Ausbleiben des besagten Anzeigesignals.

10. Ein Empfänger nach Anspruch 9, in dem die besagte Geräuschkontrollvorrichtung einen monostabilen Multivibrator (70) enthält, der das besagte Anzeigesignal empfängt, sowie einen Niedrigpassfilter (60) mit Steuerschaltung, der das besagte Audioabgabesignal empfängt, wobei der besagte Niedrigpassfilter (66) mit Steuerschaltung durch den besagten monostabilen Multivibrator angeregt wird, um die besagten Ultraschallfrequenzen abzuschwächen.

11. Eine Methode die anzeigt, dass ein FM-Signal mit einer vorbestimmten Signalqualität von einem FM-Empfänger empfangen wird, wobei die besagte Methode folgende Phasen enthält : Erzeugung eines Feldintensitätssignals, das proportional zur Feldintensität ist, mit der das besagte FM-Signal empfangen wird, Erzeugung eines gefilterten Geräuschsignals, das vom besagten Feldintensitätssignal in einen Filter abgeleitet wird, wobei mindestens Frequenzen, die unter ungefähr 100 KHz und über ungefähr 5 Megahertz liegen, abgesondert werden, Erzeugung eines ersten Signals wenn das besagte gefilterte Geräuschsignal unter einem vorbestimmten Höchstwert liegt und Erzeugung eines Anzeigesignals als Antwort zumindest auf das erste besagte Signal, um anzuzeigen, dass ein hochwertiges FM- Signal eingeht.

Revendications

1. Circuit de détection de qualité de signal d'un récepteur FM, ledit récepteur comprenant un détecteur FI générant un signal d'intensité indiquant l'intensité du champ reçu du signal FM qui est reçu et comprenant un démodulateur FM générant un signal de commande automatique de fréquence indiquant une erreur de la fréquence à laquelle ledit signal FM est reçu, ledit circuit de détection de qualité de signal comprenant des moyens de détecteur de niveau (32, 48), adapté de manière à être relié audit détecteur FI pour produire un premier signal lorsque ledit signal d'intensité est supérieur à une intensité prédéterminée, un moyen de détecteur de fenêtre (33) adapté pour être relié audit démodulateur FM afin de produire un second signal lorsque ledit signal de commande automatique de fréquence est à l'intérieur d'une fenêtre prédéterminée, caractérisé en ce que des moyens de filtre de bruit (31, 53) sont adaptés pour être reliés audit détecteur FI afin de générer un signal de bruit filtré obtenu à partir dudit signal d'intensité, les fréquences de réjection desdits moyens de filtre contenant des composantes liées aux signaux utiles contenus dans ledit signal FM, un moyen de détecteur de crête (31) relié auxdits moyens de filtre de bruit afin de produire un troisième signal lorsque ledit signal de bruit filtré est en-dessous d'une valeur crête prédéterminée, et un moyen logique (34) relié auxdits moyens de détecteur de niveau, audit moyen de détecteur de fenêtre, et audit moyen de détecteur de crête afin de produire un signal d'indication (35) en réponse à l'occurrence simultanée desdits premier, second, et troisième signaux afin d'indiquer qu'un signal FM de haute qualité est reçu.

2. Circuit selon la revendication 1, comprenant en outre des moyens de commande de seuil (51, 52) relié audit moyen de filtre de bruit (53) pour atténuer ledit signal de bruit filtré.

3. Circuit selon la revendication 1, dans lequel ledit moyen de filtre de bruit (53) présente une fréquence de coupure inférieure de manière à bloquer toutes les fréquences en-dessous d'environ 100 kilohertz.

4. Circuit selon la revendication 1, dans lequel ledit moyen de filtre de bruit (53) présente une fréquence de coupure inférieure égale à environ 200

kilohertz.

5. Circuit selon la revendication 1, dans lequel ledit moyen de filtre de bruit (53) présente une fréquence de coupure supérieure de façon à bloquer toutes les fréquences au-dessus d'environ 5 mégahertz.

6. Circuit selon la revendication 1, dans lequel ledit moyen de filtre de bruit (53) présente une fréquence de coupure supérieure égale à environ 2 mégahertz.

7. Récepteur FM pour la réception de signaux de radiodiffusion FM, comprenant, un moyen de dispositif d'accord d'étage d'entrée (42) pour s'accorder à un signal FM, un étage d'amplification FI (45) relié audit moyen de dispositif d'accord d'étage d'entrée, un détecteur FI (47) relié audit étage d'amplification FI afin de générer un signal d'intensité de champ, un démodulateur FM (46) relié audit étage d'amplification FI (45), ledit démodulateur FM générant un signal de commande automatique de fréquence et un signal de sortie audio et le circuit de détection de qualité de signal selon la revendication 1.

8. Récepteur selon la revendication 7, comprenant en outre, un moyen de dispositif d'accord par balayage (52) relié audit moyen de dispositif d'accord d'étage d'entrée (42) et audit moyen logique afin d'accorder par balayage ledit récepteur en réponse à un signal d'initialisation et afin d'arrêter ledit accord par balayage en réponse audit signal d'indication.

9. Récepteur selon la revendication 7, comprenant en outre, un moyen de contrôleur de bruit (70) relié audit démodulateur FM (46) et audit moyen logique afin de réduire les fréquences ultrasonores contenues dans ledit signal de sortie audio dudit démodulateur FM (46) en réponse à l'absence dudit signal d'indication.

10. Récepteur selon la revendication 9, dans lequel ledit moyen de contrôleur de bruit comprend un multivibrateur monostable (70) recevant ledit signal d'indication et un filtre passe-bas (60) commandé par commutateur recevant ledit signal de sortie audio, ledit filtre passe-bas (66) commandé par commutateur étant activé par ledit multivibrateur monostable afin d'atténuer lesdites fréquences ultrasonores

11. Procédé pour indiquer qu'un signal FM présentant une qualité de signal prédéterminée est reçu par un récepteur FM, ledit procédé comprenant les étapes consistant à, générer un signal d'intensité de champ proportionnelle à l'intensité de champ à laquelle ledit signal FM est reçu, générer un signal de bruit filtré obtenu à partir dudit signal d'intensité de champ dans un filtre qui réjecte au moins les fréquences en-dessous d'environ 100 kilohertz et au-dessus d'environ 5 mégahertz, générer un premier signal lorsque ledit signal de bruit filtré est en-dessous d'une valeur de crête prédéterminée, et générer un signal d'indication en réponse à au moins ledit premier signal afin d'indiquer qu'un signal FM de haute qualité est reçu.

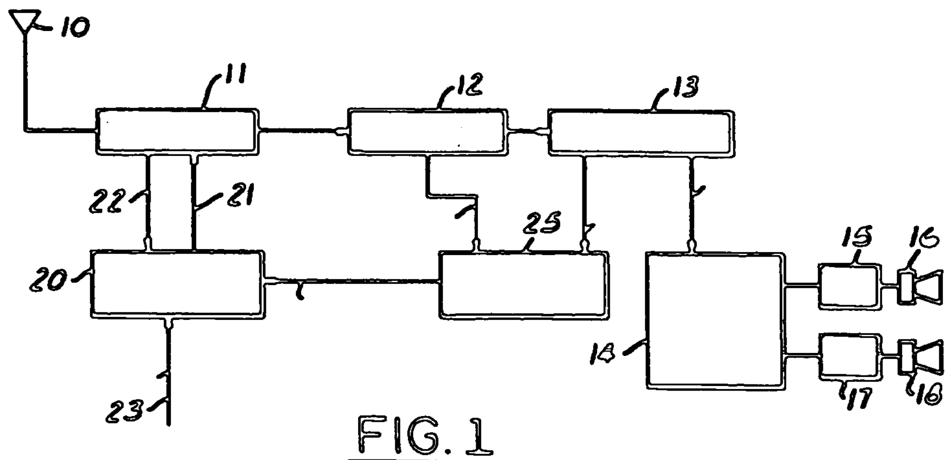


FIG. 1

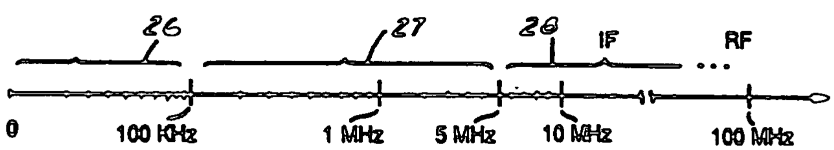
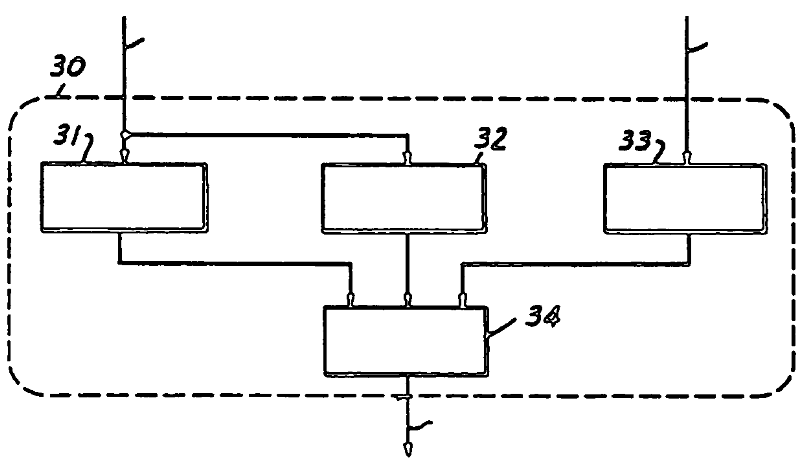


FIG. 2

FIG. 3



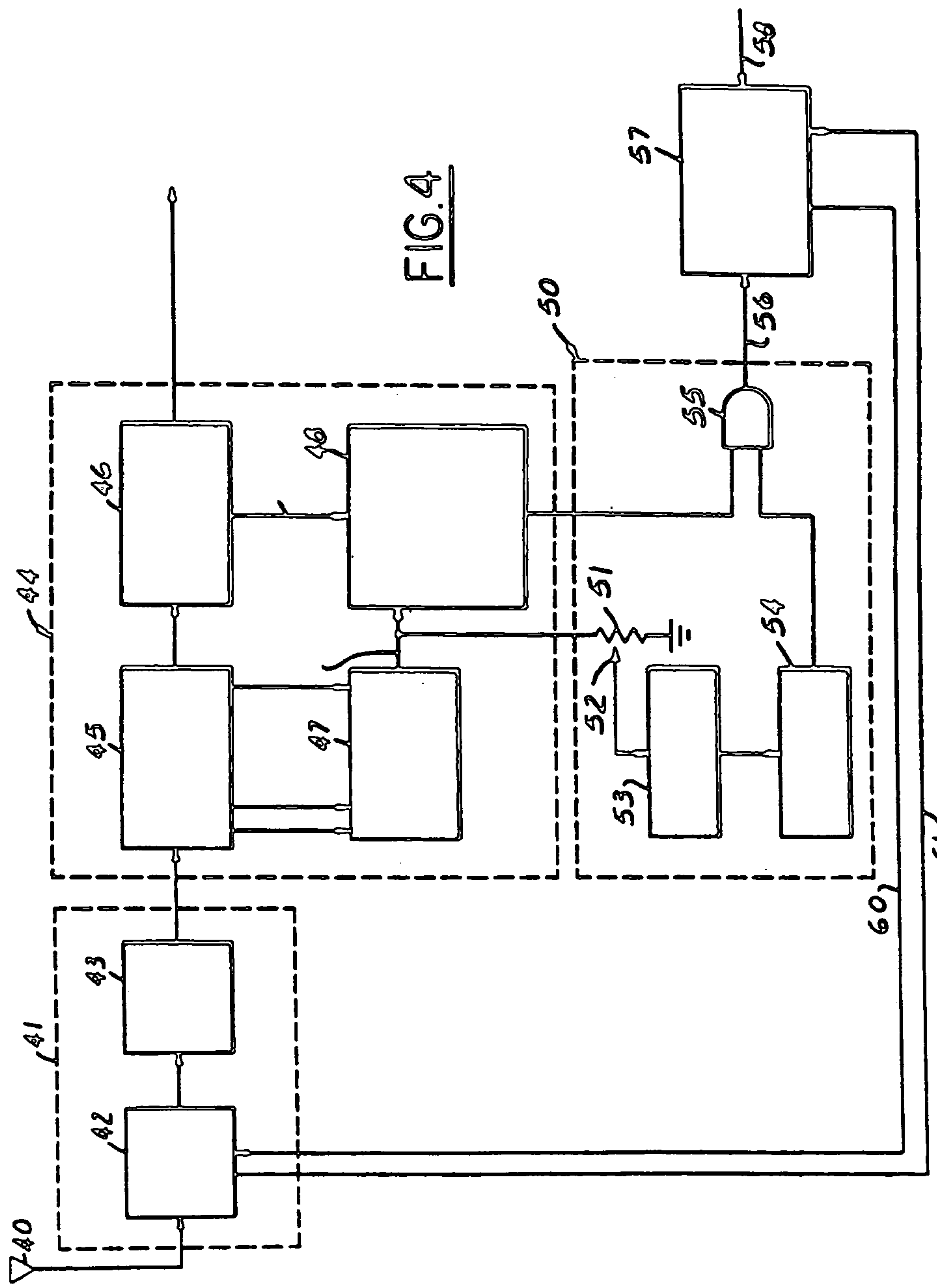


FIG. 4

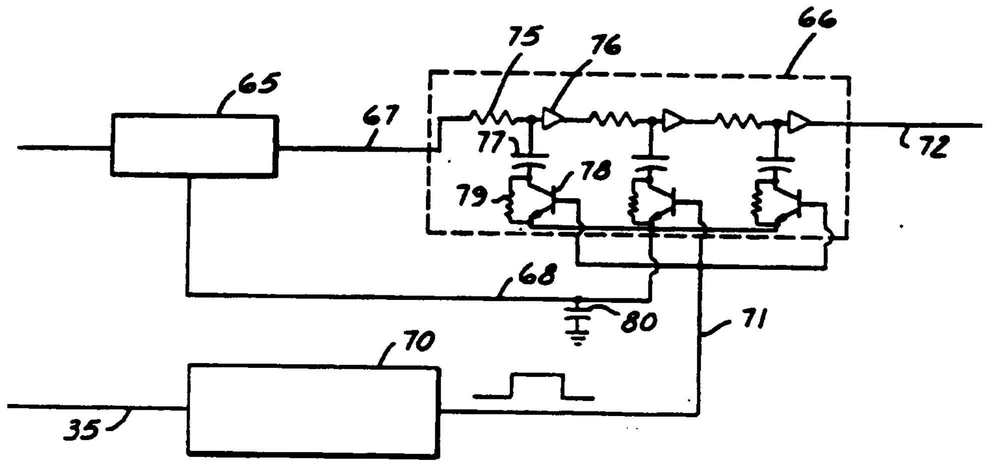


FIG.5